

CLAIMS

1. A method for treating a polymetallic sulfide ore containing gold or silver, and further comprising a base metal selected from the group consisting of iron, aluminum, chromium, titanium, copper, zinc, lead, nickel, cobalt, mercury, tin, and mixtures thereof, the method comprising:
 - (a) grinding said polymetallic ore to produce granules;
 - (b) oxidizing said granules at temperatures of at least about 300°C to produce oxidized granules;
 - (c) chloride leaching said oxidized granules to produce a pregnant solution of solubilized metal chlorides and a barren solid;
 - (d) recovering said barren solid from said pregnant solution to produce a purified pregnant solution; and
 - (e) selectively recovering gold or silver from said purified pregnant solution yielding a solution essentially deprived of gold or silver.
- 15 2. The method of claim 1, further comprising subsequent treatment of the solution deprived of gold or silver so as to precipitate and remove solubilized base metal chlorides.
3. The method of claim 1, wherein in step (b) said oxidizing is performed using lean air.
- 20 4. The method of claim 1, wherein in step (c) said chloride leaching involves contacting said oxidized granules with a leaching solution comprising a brine solution including a dissolved halogen.

5. The method of claim 1, wherein in step (d) said recovering eliminates the barren solid from the pregnant solution of solubilized metal chlorides as a filtrate, and wherein the barren solid is washed with a brine solution to produce washings and a sterile solid, the washings being combined with the 5 filtrate to produce said purified pregnant solution.
6. The method of claim 2, wherein said solution deprived of gold or silver is treated with a caustic solution to produce a first reaction mixture having a pH ranging from about 2.5 to about 3.5, further producing a precipitate comprising a first set of base metals comprising a hydrated metal oxide 10 selected from the group consisting of iron, aluminum, chromium and titanium, and recovering said precipitate yielding a first solution essentially devoid of iron, aluminum, chromium and titanium.
7. The method of claim 6, further comprising the subsequent step of treating said first solution with a caustic solution to produce a second reaction 15 mixture having a pH ranging from about 3.5 to about 14, further producing a precipitate including a second set of base metals comprising a hydrated metal oxide selected from the group consisting of nickel, copper, cobalt, zinc, lead and tin, and recovering said precipitate yielding a second solution essentially devoid of nickel, copper, cobalt, zinc, lead and tin.
- 20 8. The method of claim 3, wherein following said oxidizing, said lean air is cooled in a settling chamber allowing for a volatile species to be collected; wherein a first portion of said lean air and sulfur dioxide is recycled from said settling chamber to said oxidizing step; and wherein a second portion of said lean air and sulfur dioxide is directed to a sulfur dioxide scrubbing unit.

9. The method of claim 8, wherein in said scrubbing unit said sulfur dioxide is converted to calcium sulfate dihydrate following treatment with an aqueous limestone slurry.

10. The method of claim 9, wherein said calcium sulfate dihydrate is
5 subsequently dried.

11. The method of claim 8, wherein said volatile species comprise mercury, arsenic oxide and zinc oxide.

12. The method of claim 8, wherein said lean air includes an oxygen content of about 10%.

10 13. The method of claim 3, wherein said oxidizing is performed at temperatures ranging from about 400 to about 600°C.

14. The method of claim 4, wherein a first portion of a brine solution is circulated through an electrolytic cell to separately and concomitantly produce a caustic solution and said brine solution including dissolved halogens, and
15 wherein said brine solution including dissolved halogens is combined with a second portion of said brine solution to produce said leaching solution.

15. The method of claim 14, wherein said brine solution includes a concentration of sodium chloride ranging from about 275 g/L to about 300 g/L.

16. The method of claim 14, wherein said brine solution includes a
20 concentration of potassium chloride ranging from about 190 g/L to about 225 g/L.

17. The method of claim 1, wherein in step (e) said purified pregnant solution is treated with carbon to produce a reaction mixture including a carbon cake rich in gold or silver, and wherein the carbon cake is removed from the reaction mixture to produce said solution essentially deprived of gold
5 and silver.

18. The method of claim 17, wherein said gold or silver is stripped from said carbon cake and wherein said gold or silver is selectively recovered by a process selected from leaching followed by electrowinning, and precipitation.

19. The method of claim 5, wherein said sterile solid is washed with water
10 to produce a salt containing solution, said salt containing solution being concentrated and recycled to said leaching step (c).

20. The method of claim 6, wherein said precipitate is washed with a brine solution to produce washings and a washed residue, said washings being combined with said first solution essentially devoid of iron, aluminum,
15 chromium and titanium.

21. The method of claim 7, wherein said second solution essentially devoid of nickel, copper, cobalt, zinc, lead and tin is recycled to said leaching step (c).

22. The method of claim 19, wherein said salt containing solution includes
20 salts selected from the group consisting of sodium chloride and sodium bromide.

23. The method of claim 19, wherein said salt containing solution includes salts selected from the group consisting of potassium chloride and potassium bromide.
24. The method of claim 14, wherein said halogens are selected from the 5 group consisting of chlorine and bromine.
25. The method of claim 5, wherein said brine solution comprises a concentration of sodium chloride ranging from about 275 g/L to about 300 g/L.
26. The method of claim 5, wherein said brine solution comprises a concentration of potassium chloride ranging from about 190 g/L to 10 about 225 g/L.
27. The method of claim 14, wherein said brine solution further includes a bromide salt selected from the group consisting of sodium bromide and potassium bromide.
28. The method of claim 27, wherein said bromide salt is present in a 15 catalytic amount.
29. The method of claim 28, wherein said catalytic amount is ranging from about 1.0 g/L to about 3.0 g/L.
30. The method of claim 4, wherein said chloride leaching is carried out at ambient temperatures over a period ranging from about 2 to about 5 hours.
- 20 31. The method of claim 30, wherein said ambient temperatures range from about 35 to about 45°C.

32. The method of claim 6, wherein said caustic solution is a sodium hydroxide solution.
33. The method of claim 6, wherein said caustic solution is a potassium hydroxide solution.
- 5 34. The method of claim 17, wherein said carbon is activated carbon.
35. The method of claim 3, wherein said granules have a particle size ranging from about 35 mesh to about 200 mesh.
36. The method of claim 35, wherein about 80% of said granules have a particle size of less than 35 mesh and wherein about 20% of said granules 10 have a particle size of less than 200 mesh.
37. The method of claim 35, wherein about 20% of said granules have a particle size of less than 35 mesh and wherein about 80% of said granules have a particle size of less than 200 mesh.
38. The method of claim 13, wherein said oxidized granules have a sulfur 15 content inferior to about 0.5%.
39. The method of claim 19, wherein said sterile solid may include ferric arsenate.
40. The method of claim 1, wherein said gold or silver are recovered in yields in excess of about 80%.
- 20 41. The method of claim 1, wherein said polymetallic sulfide ore comprises gold and silver.